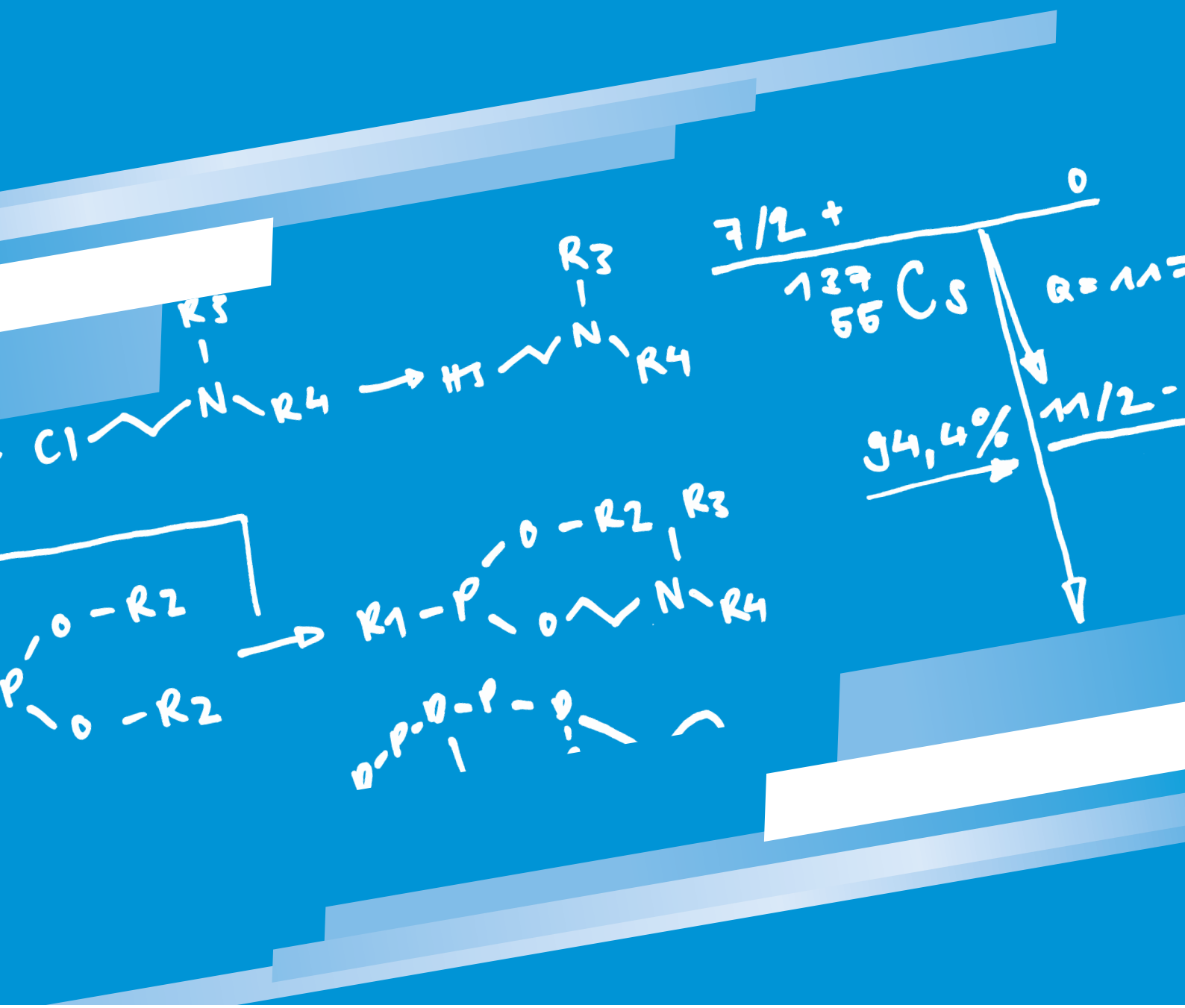
Annual Report
2019

SPIEZ LABORATORY



Schweizerische Eidgenossenschaft
Confédération suisse
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Federal Office for Civil Protection FOCP
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Published by
The Federal Department of Defence,
Civil Protection and Sport DDPS
Federal Office for Civil Protection FOCP
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Images
Spiez Laboratory
BBS Ingenieure AG (16, 17, 18, 19)
BM Photos (20, 21)

This Annual report is also available in German and French.

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Dear Readers,

Dr Marc Cadisch
Director Spiez Laboratory

You will not be surprised to learn that Spiez Laboratory, the Swiss Federal Institute for NBC Protection, was and still is directly involved in the fight against the COVID-19 pandemic. We were one of the first Swiss laboratories to detect SARS-CoV-2 and our expertise in the field of NBC personal protective equipment was in great demand. In view of the major problems in supplying the health care system with protective masks, we developed ad hoc testing methods and were able to provide effective support for procurement by the Federal Government. This exceptional situation required us to adapt our ways of working – whilst ensuring that the full range of our laboratory and NBC response services remained available at all times. I am pleased that so far we have managed to do so.

These additional challenges had an impact on scheduled projects – for example, this annual review for 2019 appears later than planned. However, I am convinced that a report on our past activities is important and worthwhile – even if received with some delay.

Our work in 2019 was less in the media focus than in previous years. It was therefore a rather «quiet» year for Spiez Laboratory – which is a positive development in our line of work: last year there were no major NBC events, which allowed us to focus on our technical work, on the continuous development of our expertise and on cooperation with our long-term partners. Maintaining and further developing our specialist know-how in a wide range of NBC protection issues, is and remains the foundation of our success.

The following reports from our experts are examples of this:

Federal Councillor Viola Amherd visits the biosafety laboratory in Spiez (Nov. 2019).

- The Nuclear Chemistry Division draws a positive conclusion after 4 years as a designated Collaborating Centre of the International Atomic Energy Agency (IAEA). Their work focused on environmental missions in Japan and the South Pacific as well as on the establishment of sophisticated radio-analytical methods (page 6).
- The Biology Division reports on the surveillance of mosquitoes as carriers of the West Nile Virus. At present, the virus is not yet widespread in Switzerland, but it has firmly established itself in Italy near to the border with Switzerland (page 10).
- The Chemistry Division explains how in the event of a major incident our analytical services are supported by NBC specialists from the Swiss Army – a mechanism of the Swiss military system that has just demonstrated its value by assisting the Biology Division in COVID-19 diagnostic analysis (page 14).
- The NBC-Protection Division provides an overview about its participation in the largest blast test to take place in Europe so far. The experiment in Sweden allowed them to carry out a realistic investigation of questions relating to protective infrastructures (page 16).
- Finally, the Logistics, Quality, Safety & Security Division shows how containment in the biosafety laboratory is guaranteed to the highest safety level 4 (page 20).

Even if our work remained more in the background, 2019 still saw us in action. As a designated laboratory for international organisations, we especially helped to support and shape Switzerland's disarmament and arms control policy. Technical and scientific aspects of arms control continue to be among the core tasks of our institute. By creating a new Staff Unit for NBC Arms Control – part of a major reorganisation in 2020 - we have increased our strength in this field. In view of international developments, it is evident that our work in this area will not end anytime soon ...

Our activities significantly contribute to an effective NBC protection for the Swiss population and help strengthen the credibility of global arms control efforts. In cooperation with national and international partners, we will persevere with our contributions to security not only in Switzerland, but also worldwide. I would like to express my sincere thanks to all our partners for their constructive and excellent cooperation.

Spiez as IAEA Collaborating Centre – a review

Spiez Laboratory received the designation Collaborating Centre of the IAEA in 2017. Collaborating Centres are scientific institutions that work together with IAEA divisions in areas such as environmental protection, resource management or quality assurance. The cooperation with the IAEA focuses on missions in the field of environmental protection and the establishment of radioanalytical methods of the highest standard. In 2019, we again organised various courses and participated in international missions.

Samples from the coastal waters off Fukushima, Japan

At the invitation of the IAEA and Japan, the Nuclear Chemistry Division (NC) participated in an IAEA mission to collect samples from seawater, sediments and fishery products from coastal waters in front of the decommissioned Fukushima Daiichi reactor complex. The mission took place from 3 to 14 June. It was organised on recommendations for marine surveillance (already published by the IAEA in 2013), and was intended to support the quality assurance of the collection and analysis of radioactivity data by Japanese laboratories.

The samples were sent to Canada and Spiez for detailed testing. In Spiez we analysed 20 seawater samples from 5 locations (total 310 kg sea water), 6 fish samples of different species and 3 sediment samples. The analyses covered all radioisotopes that are relevant after a Nuclear Power Plant event

Selection of fish samples from the coastal waters off Fukushima for analysis in Spiez.

Expert workshop for in situ gamma spectrometry.

and that can be measured with gamma spectrometry without sample digestion.

The results of the mission confirmed previous comparison and sampling missions: the Japanese sampling organisation and the laboratories that analyse the sample material provide reliable data in compliance with international standards.

From a radiological point of view, the environmental situation in the sea off Fukushima Daiichi in 2019 is not alarming: The analyses of uranium and plutonium isotopes in sediments show that the radioisotope inventory that was collected, cannot significantly be assigned to the Fukushima event. The main contribution comes from the fallout of earlier nuclear weapons testing. Such a clear result is now available for the first time. The fire in the holding basins during the disaster introduced hardly any nuclear material into the marine zone off Fukushima. If Japan and the IAEA would like to investigate this more closely, Spiez Laboratory is ready to provide analytical support for another project.

The samples from Fukushima were sent to Canada and Spiez for detailed testing.

Expert workshop for in situ gamma spectrometry

For the second time since 2015, we organised a workshop on in situ gamma spectrometry for the ALMERA network (Analytical Laboratories for the Measurement of Environmental Radioactivity). In contrast to the first workshop, which provided basic knowledge of in situ gamma spectrometry, the advanced workshop held from 21–25 October 2019 was aimed at experts with in-depth knowledge.

In situ gamma spectrometry encompasses methods which allow reliable statements about the activity levels of radionuclides emitting gamma rays directly on site and without sampling. Typical objects to be measured include contaminated soils and surfaces, radioactive material in various containers and inaccessible radioactive sources.

Since no samples are taken using this measurement method and personnel must enter the radiation field of the measurement object with the gamma spectrometer, various aspects of the measurement process must be specifically practiced. In addition to the correct operation of the portable gamma spectrometer and use of radiation protection measures, we also practiced working with the calibration software ISOCS ™ (In Situ Object Counting System). The decisive factor for the significance of such measurements is the creation of adequate models, which, among other

things, must take account of the correct assessment of the situation as well as the measurement experience of the analysts.

Nineteen participants from fourteen countries took part in nine exciting tasks that were prepared in Spiez, on Mont-Vully and at the Grimsel Test Site. Two representatives from the IAEA accompanied the workshop. They also compiled the measurement results and assessed the results in consultation with the organisers from Spiez Laboratory. Thanks to the formation of eight small teams, each of which was supervised by an instructor from Switzerland, we were able to achieve a high level of learning efficiency.

Capacity building in the Marshall Islands

To support the development of a national radioactivity monitoring capacity in the Marshall Islands, an expert from the Nuclear Chemistry Division participated in another IAEA mission. The aim of the mission was to train the persons responsible on site in sampling, pretreatment techniques and radioactivity analysis. The mission was intended to refresh an initial training held in 2017 and to expand the knowledge of the local authorities to include additional techniques.

The mission included a radiation study of the Bikar and Bokak atolls, both are atolls in the north of the Marshall Islands that were affected by US nuclear tests. Numerous water and land samples were collected, including seawater, sediments, soil, fish, mussels and algae. The samples were prepared for radioactivity counting and analysed by gamma spectrometry at the laboratories on the main island. The samples underwent a detailed radioisotope analysis in Spiez. A full report of the results was submitted to the IAEA and the local authorities in the Marshall Islands. This work is intended to contribute to a comprehensive surveillance study and to facilitate comparison with data from previous studies.

Cooperation Isotope Hydrology

We work with the IAEA's Isotope Hydrology Section to promote the use of nuclear technology in water pollution control. Isotope hydrology is based on the fact that water is marked both naturally and artificially by radioactive isotopes. Generally water al-

Sampling on Bikar Island.

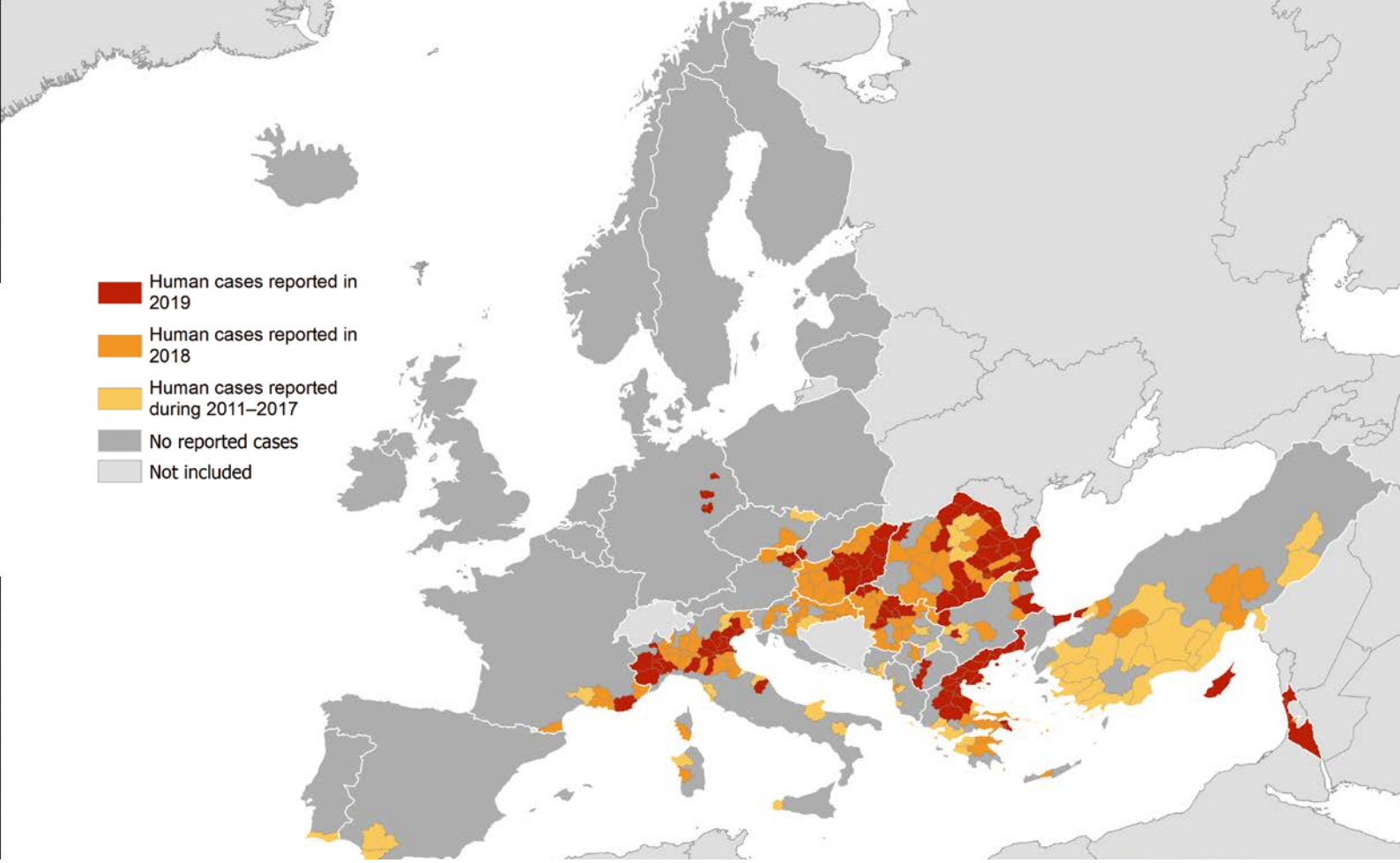
Preparation of the samples in the RMI EPA Laboratory, Majuro, Marshall Islands.

ways contains stable and frequently radioactive isotopes, on the other hand, radioactive isotopes are released as waste products from nuclear reactors and nuclear weapons tests into the environment and thus into the water cycle. Surface water and groundwater can be marked by adding radioactive substances (tracing). The most important area of application for isotope measurements is the study of the natural water cycle. We have contributed as lecturers for national and regional trainings (e.g. in Jamaica, Costa Rica, Cameroon, Ghana, Thailand and Jordan).

In 2019 we also organised the following courses:

- Use of isotope techniques in groundwater dating for the Mexico City region: the course trained participants in the use of isotope and tracer techniques to determine the age of groundwater – an important tool for the assessment and management of hydrogeological systems.

- Basic course in radiochemistry as part of the IAEA project RAS7032 «Assessment of pollution of water resources through the use of chemical and ecological isotope techniques». The training for participants from Jordan focused on the measurement of radionuclides with the help of alpha spectroscopy and gas proportional counters.



The West Nile Virus is endemic in northern Italy. It is regularly transmitted to humans near the border with Switzerland.

Surveillance of mosquitoes as carriers of the West Nile Virus

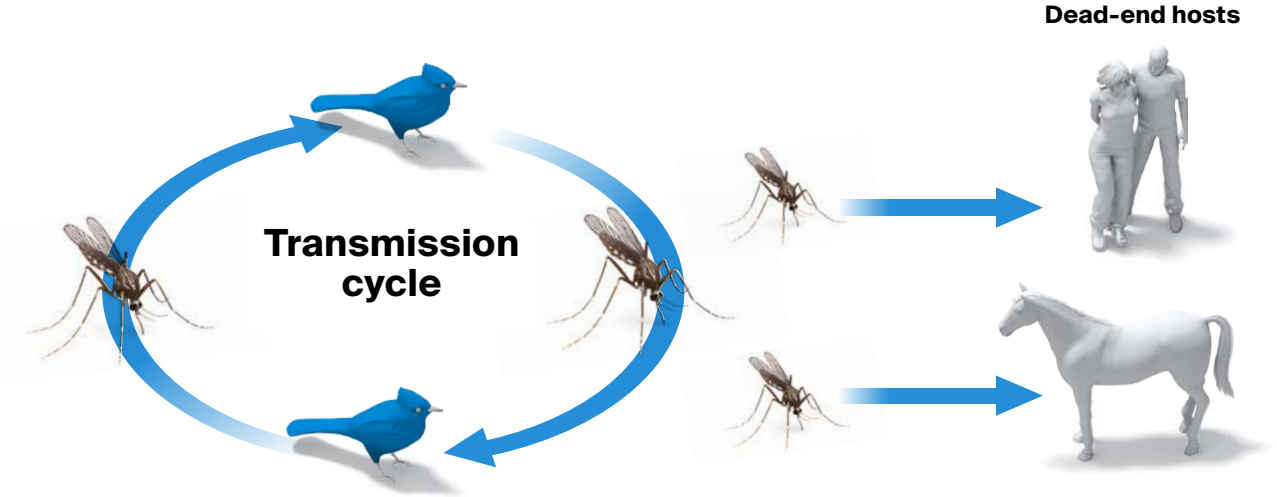
The spread of viruses transmitted by mosquitoes is a problem for public health. The West Nile Virus plays an increasingly important role in Europe. Although the infections are usually harmless, in about 1% of cases they can cause a life-threatening inflammation of the brain. The virus is introduced by migratory birds and transmitted to humans and some animal species via local mosquito populations. At present, the virus is not yet widespread in Switzerland, but it has firmly established itself in Italy near to the border. In order to detect the spread of the virus in Switzerland at an early stage, a monitoring system for mosquito-borne diseases is being established.

West Nile Virus (WNV) like Tick-borne encephalitis (TBE) and yellow fever viruses, which are also transmitted by insects, belongs to the flavivirus family. Its name originates from the West Nile district of Uganda, where the virus was first isolated in 1937. Migratory birds carry the virus from endemic areas in Africa and the Middle East to Europe. In parts of Southern Europe it has been established for years; it is transmitted by the mosquito population each summer and can survive the winter in the area.

In 2018, the numbers of WNV infections in Europe increased in comparison to previous years. A total of 2083 human infections were reported, mainly in Italy, Serbia and Greece. The virus has been endemic in northern Italy for several years, and transmission to humans occurs regularly near the border to Switzerland. In Switzerland, WNV has so far only been detected in returning travellers who were infected outside of Switzerland.

Types of Surveillance

Surveillance of the West Nile Virus situation in Switzerland is carried out by reporting cases of disease to the health authorities as well as by controlling mosquitoes and birds as vectors and hosts. A further approach involves regular serological test of so-called Sentinel animals kept at strategic locations, for a past infection with West Nile Virus. For this purpose, blood is regularly taken from the Sentinel animals and tested for virus-specific antibodies. Both methods have the disadvantage that the information about the spread of the viruses is only available with a delay.



West Nile Viruses enter new regions through migratory birds and are maintained in a mosquito-bird-mosquito transmission cycle. In Europe, mosquitoes of the genus Culex are the main vectors. They can transmit the virus to local bird species, which serve as a reservoir for the viruses. Within the mosquito populations, WNV is transmitted by vertical transmission (transmission from the adult animal to the eggs). Transmission to humans and horses usually involves the mosquito species Cx. pipiens and Cx. Torrentium, which also exist in Switzerland. Horses, just like humans, are so-called dead-end hosts, which means that although they are infected, they cannot spread the virus.

The surveillance of vectors is therefore a useful addition because, with an optimal established surveillance strategy, the spread of the virus can be detected at an early stage. The mosquito pool screening method frequently used for this purpose is based on the collection and processing of thousands of mosquitoes. This method requires a daily check of mosquito traps, a constant cold chain to maintain the viral RNA in the mosquitoes, as well as complex processing and analysis of the mosquito pools using molecular biological methods. The percentage of infected mosquitoes in regions with low transmission is low; therefore, the effort for this kind of mosquito surveillance is relatively high.

An innovative strategy for the detection of viruses in infected mosquitoes was developed in Australia several years ago.

New Strategies

An innovative strategy for the detection of viruses in infected mosquitoes was developed in Australia several years ago. The method is based, on one hand, on the property of FTA (Flinders Technology Associates) cards to bind and preserve viruses on chemically treated cellulose surfaces; on the other hand, that infected mosquitoes release viruses during sugar absorption. If the FTA cards are coated with a sugar solution and integrated into mosquito traps, the trapped mosquitoes consume sugar solution from the card, causing their saliva with the viruses to be transferred to the cards. The viruses fixed on the FTA cards can be detached and detected by molecular biology.

Study at Spiez Laboratory

The aim of our study was to clarify whether this Australian strategy could also be used in Switzerland. To this end, we conducted a field study over several years to investigate the suitability of the FTA cards for detecting viruses under natural conditions. From a selection of three commercially available trap types, the type that achieved the best results in combination with FTA cards was to be selected. In addition, the sensitivity of the system compared to the traditional mosquito pool strategy was to be assessed by testing the captured mosquitoes for viruses in parallel to the testing of the corresponding FTA cards.

Results

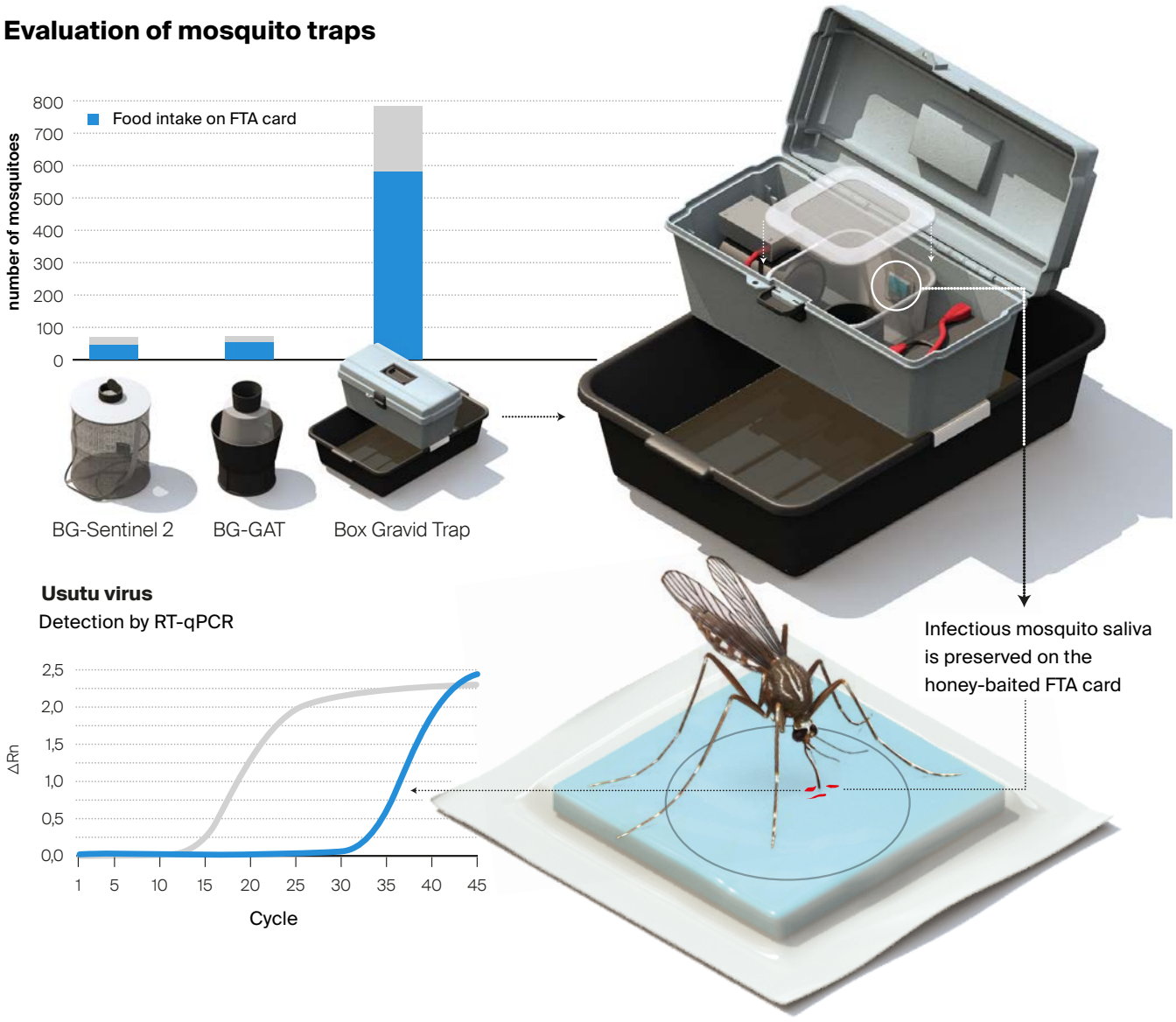
Preliminary investigations showed that flaviviruses on the FTA cards are completely inactivated after only a few minutes and that samples can be processed further without any risk. In addition, we found that the viral genome on the cards is stably conserved up to a temperature of at least 37 °C and that even after two weeks viral sequences can be detected with molecular biology methods without signal loss.

Surveillance of mosquitoes as carriers of the West Nile Virus

For the evaluation of the FTA cards, we equipped three mosquito traps (BG-Sentinel 2, BG-GAT and Box Gravid Trap) in Ticino with FTA cards, and the FTA cards were coated with a blue coloured sugar solution. We positioned the 3 types of mosquito traps at the same location at intervals of 10 meters and checked them daily. The positions of the mosquito traps were rotated so that each trap was placed twice at each location. The number of mosquitoes caught allowed us to assess the efficiency of the traps. Those mosquitoes that had also absorbed the coloured sugar solution from the FTA cards showed a blue discolouration in the abdomen. This allowed us to assess how many mosquitoes had consumed sugar from the FTA cards and ideally had given off saliva onto the cards.

The field study showed that the Box Gravid Traps caught on average more than eleven times more mosquitoes than the other traps. In addition, the mosquitoes remained physically intact because, unlike the other models, this trap does not suck them in by a fan. Instead, in the Box Gravid Traps the mosquito females are selectively trapped, attracted by the smell of the attractant (rotting hay). The count of the mosquitoes showed that after 48 hours an average of 76% of them had fed on the sugar-saturated FTA cards. Thanks to the FTA cards, the effort is significantly reduced, as the mosquito traps do not have to be emptied daily. The cards can be collected after 14 days and no cold chain is required. Due to the large number of mosquitoes caught and the high feeding rates, the

Evaluation of mosquito traps



Box Gravid Trap proved to be an optimal trap for mosquito surveillance. In addition, the FTA cards and the mosquitoes in the traps were examined for virus genome sequences using molecular biology methods. In addition to many sequences of mosquito specific viruses that are not relevant for humans, we could repeatedly identify the Usutu virus, both in the mosquitoes and on the FTA card from the same Box Gravid Trap. The Usutu virus is a virus that occurs sporadically in Europe and is closely related to other flaviviruses such as the Japanese encephalitis virus and WNV. The fact that the Usutu viruses have been repeatedly detected in mosquito pools and on the FTA card in the same Box Gravid Trap speaks for the suitability of the FTA card approach for surveillance in an area with low virus prevalence. In order to determine which mosquito species transmit the virus, monitoring could be usefully supplemented in a second phase by the targeted capture and analysis of mosquitoes.

The Analytical Chemistry Branch and the NBC Defence Laboratory 1 of the Swiss Armed Forces

In the event of an incident involving chemical warfare agents in Switzerland, numerous samples would most likely accumulate over time. These samples have to be analysed by the Analytical Chemistry Branch of Spiez Laboratory. In such a case, the laboratory could count on the C-specialists of the NBC Defence Laboratory 1. This support by the Armed Forces allows a significant increase in the quantitative work performance and endurance of the Spiez analytical chemists.

Examples from the recent past have shown that even for small, locally limited events involving chemical warfare agents, a large number of samples must be analysed. In a first phase, chemical analysis must answer questions as quickly as possible about the identity of the chemical warfare agent, its spread and, if possible, its source. In a second phase, extensive measurements are necessary to monitor the effectiveness of decontamination and to certify a site as clean. An example of this is the attack on the former Russian intelligence officer Sergei Skripal and his daughter Julia in March 2018 in Salisbury, UK. Since the assassins had used only a few grams of a Novichok-class chemical warfare agent, the spread of contamination remained relatively limited. Despite this, over a period of several months and around the clock, the British Defence Science and Technology Laboratory (DSTL) Porton Down had to analyse thousands of samples of various nature and origin. The British institute was only able to meet this enormous challenge by installing additional laboratory infrastructure and increasing staff.

Army specialists are trained in sample preparation and instrumental analysis.

In the event of a major nuclear (N), biological (B) or chemical (C) event in Switzerland, Spiez Laboratory could not maintain a 24/7 operation for a longer period of time without additional support, due to its limited personnel capacity. For this reason and after the reactor disaster in Chernobyl in 1986, the Army Laboratory ACSD 86, which later became the NBC Defence Laboratory 1 of the Swiss Army, was created to support the physicists in Spiez. The NBC Defence Laboratory 1 is maintained by specialists who have not only completed the NBC Defence Recruit School at the NBC-EOD Centre of Competence in Spiez, but who also work as physicists, biologists or chemists in their civilian lives. During three-week refresher courses, the N, B and C specialists are trained to support the experts from Spiez Laboratory's specialist divisions during major events. This involves the use of a range of qualitatively and quantitatively excellent instruments, the majority of which are financed from the Swiss Armed Forces budget.

Training of the C-specialists

During a half-day introductory event at the beginning of the refresher courses, the C-specialists are given an overview of the tasks from Spiez Laboratory and the Analytical Chemistry Branch (OA), as well as of the Chemical Weapons Convention (CWC) and the Organisation for the Prohibition of Chemical Weapons (OPCW). The introduction also includes presentations on the history of chemical warfare agents as well as analytical methods and degradation reactions.

In the first and second week of the refresher course, training modules are used for the analysis of chemical warfare agents and related com-

As part of the exercise, the C-specialists have to analyse hundreds of samples within two and a half days.

pounds. The C-specialists are trained in sample preparation and instrumental analysis. This training in theory and practice is aimed at enabling the C-specialists in consultation with the OA experts, to safely process various samples, to operate the analytical systems as independently as possible and to interpret the results together with the experts from Spiez.

The C-specialists receive instructions for the preparation of material and environmental samples, as well as for the detection and identification of chemical warfare agent relevant compounds by means of gas chromatography, liquid chromatography-mass spectrometry and nuclear magnetic resonance spectroscopy. C-specialists with appropriate knowledge in organic synthesis receive additional training in the production of reference compounds.

Operational exercise

If many samples of unknown composition have to be analysed in a short time, some improvisation in terms of the strategy for sample preparation and analysis as well as for the organisation of work in the laboratories is required. In order to check and consolidate the cooperation between the staff in Spiez and the C-specialists of the Armed Forces, an operational exercise with various scenarios takes place in the third week of the refresher course. During the exercise, the C-specialists, guided by the Spiez experts, work on analysis requests where several hundred samples have to be prepared and analysed within two and a half days. These exercises were always completed successfully, due to the commitment and dedication of all involved. Because of the support of NBC Defence Laboratory 1, the Spiez experts remain prepared for major events.

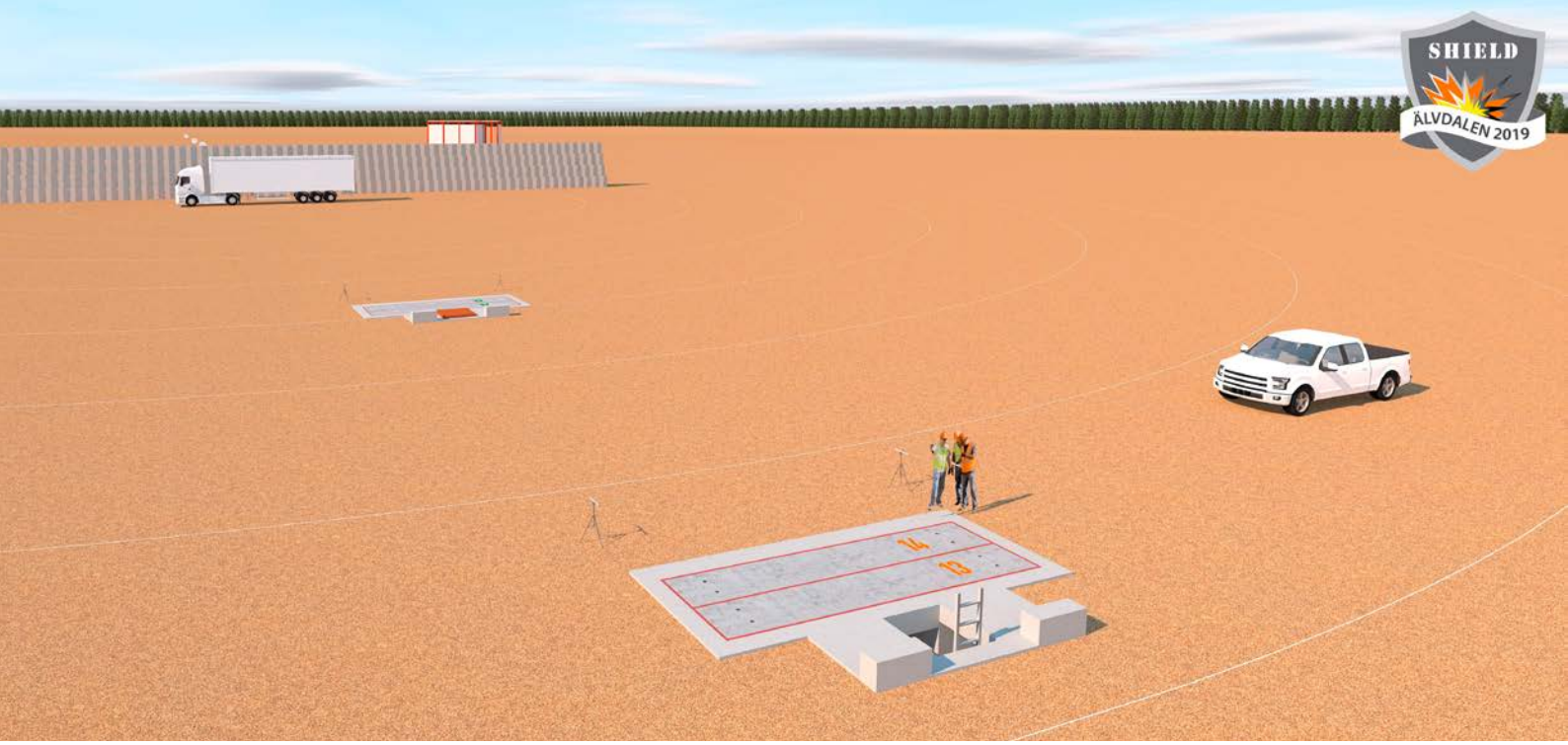


Illustration of the test site in Älvdalen.

Large Blast Test SHIELD 2019 Air blast load – numerical simulation and reality

In August 2019, the large-scale blast test SHIELD 2019 took place in Sweden. In addition to Switzerland, Sweden, Norway, Germany and the USA participated with numerous experiments. In the context of structural protection, the Federal Office for Civil Protection (FOCP) conducted load tests with reinforced concrete structures. Spiez Laboratory accompanied the assembly of these experiments and the installation of the measurement instruments. The Collective Protection Branch part of the NBC-Protection Division implemented extensive numerical calculations simulating the air blast propagation.

In August 2019, under the designation SHIELD[1], a truck loaded with 38 tonnes of ANFO[2] explosive was detonated near the Swedish town of Älvdalen. Such a large-scale experiment with a vehicle bomb was a first in Europe. For the participating partner organisations, SHIELD provided an opportunity to investigate issues related to structural protection under close-to-real-world conditions.

Switzerland's participation in SHIELD was initiated and coordinated by the Study Group on Military Infrastructure Protection (SG SIM) from armasuisse Real Estate. In the context of the FOCP project involving reinforced concrete structures, Spiez Laboratory supported armasuisse's S + T (Science and Technology) test centre and EMPA[3] Dübendorf in the field of measurement technology. The Collective Protection Branch calculated the fundamentals of the expected air blast loads. The air blast propagation was computed using the CFD[4] programme «Apollo Blast Simulator».

Starting point and objectives

The protective structures used for the protection of the population and defence are dimensioned to withstand the impact of conventional as well as nuclear weapons. Often, the load resulting from the air blast of an explosion is the most important factor. Revisions of the SIA[5] standards have resulted in the need to adapt the Technical Directives for the Design and Dimensioning of Protective Structures (TWK[6]).

1 Super Heavy Improvised Explosive Loading Demonstration
2 Ammonium Nitrate Fuel Oil
3 Swiss Federal Laboratories for Materials Science and Technology
4 Computational Fluid Dynamics
5 Swiss Society of Engineers and Architects
6 TWK 2017 – Technical Directives for the Design and Dimensioning of Protective Structures, Federal Office for Civil Protection FOCP

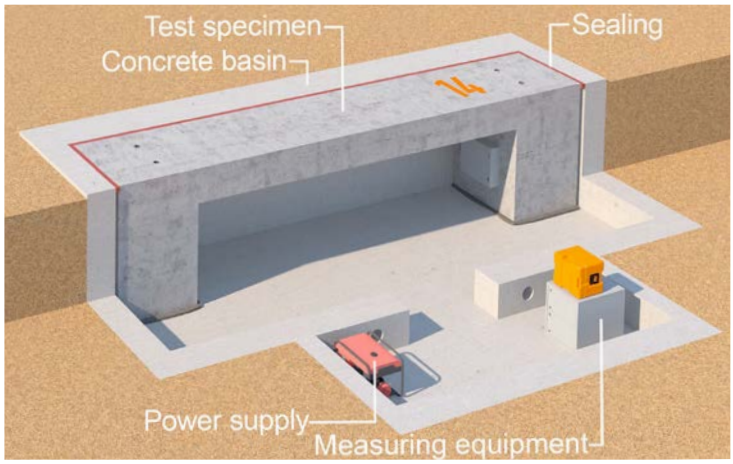


Figure 1: Concrete shelter with concrete roof slabs and a chamber for the infrastructure.

SHIELD was particularly suited for testing structures on a scale of 1:1 thanks to its remote location, the large area of the test site, and the exceptionally large explosive charge with a TNT equivalent of 30 tonnes. In order to be able to experimentally investigate the load-bearing behaviour of the ceilings of protective structures under air blast load, the FOCP participated in this experiment with the project «Civil Protection Shelter».

At the same time, Spiez Laboratory was also interested in validating its numerical simulations for terrorist scenarios. Which should make it possible to predict the impact of vehicle bombs in urban areas.

Test Setup

For the tests involving reinforced concrete structures, concrete roof slabs that had been clamped into massive, 1 metre wide supports were used. Four supports that had been manufactured by EMPA Dübendorf were transported to Sweden for use in the tests.

On the test field, two adjacent roof slabs were installed per concrete shelter. The two shelters were located 56.5 m and 83.5 m away from the detonation point. The power supply unit and the measurement instrumentation were housed in a protected chamber (figure 1).

In July 2019, coordinated by a staff member from the Collective Protection Branch of Spiez Laboratory, the roof slabs were installed in the concrete shelters at the test site. The two shelters were located 56.5 metres and 83.5 meters respectively away from the point of detonation. The 12 tonne heavy concrete roof slabs had to be accurately installed to achieve a uniform joint width between the two slabs as well as between the slabs and the shelter.

Figure 2: Installation of the joint seals.

It was necessary to prevent overflow through the joints to ensure that the air blast load during the test explosion would only affect the top of the test slab. Calculations at Spiez Laboratory using CFD simulation had shown that when joints were left open, excess pressure would build up inside the shelter, corresponding to approximately one third of the external pressure. This would have distorted the test results as well as damaged the measurement instruments. For this reason, the joints had to be sealed in a manner that would withstand the pressure load, but without obstructing the sag of the roof slabs. To seal the joints, a system that had been validated already in previous pressure surge tests at Spiez Laboratory was used. The seals were installed by specialists from the seal manufacturer (figure 2).

Measurement instrumentation
In order to achieve significant results from the experiment, the shelters and test roof slabs were equipped with a complex set of measurement instruments (figure 3). EMPA Dübendorf and armasuisse S+T were responsible for the measurement technology.

In addition to the exterior pressure and the pressure inside the shelter, measurements were taken of deformations, elongations of the armouring, and of accelerations of the test roof slabs. Furthermore cameras for video recordings were installed. No other test set up at SHIELD was equipped with measurement instrumentation as elaborate as that of the FOCP. A power supply was provided by an emergency generator to ensure that the measurement instruments functioned correctly.

Simulation of the Air Blast Propagation
In order to achieve reliable predictions of the expected air blast loads on the test roof slabs, and thereby to work out the fundamentals for dimensioning them, the Collective Protection Branch undertook numerical simulations of the air blast propagation using a CFD programme. The measurements undertaken during the experiment on the test field confirmed the calculated predictions with high accuracy.

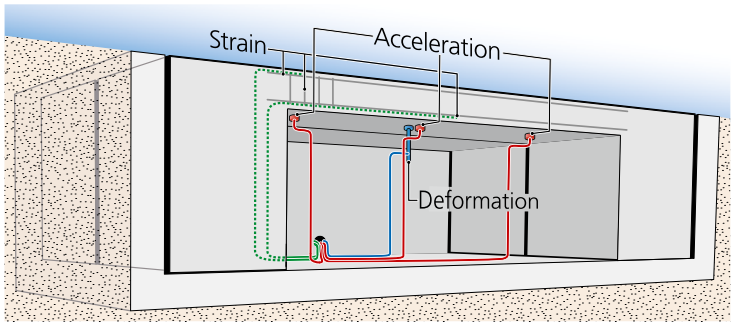


Figure 3: Measurements on the test roof slabs (schematic).

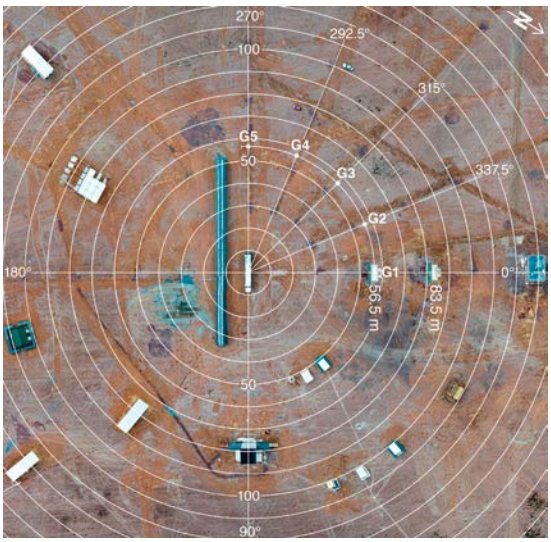


Figure 4: Aerial view of the testing site.

The aerial picture of the test array (figure 4) shows the test objects in a radial arrangement around the truck carrying the explosive charge. Ten meters to the left of the truck carrying the explosive charge, there is a 90 meter long protective bulwark belonging to a German experiment. During the explosion, the pressures in the plotted quadrant were measured from 270° to 0°.

The test array for SHIELD was modelled using «Apollo Blast Simulator» (figure 5), which included a study of the influence of the protective wall and the charge geometry. The simulation showed that air blast propagation and load depend critically on the geometry of the ANFO charge on the truck. The layout of the charge and the protective wall result in a configuration where the blast does not propagate in a radially symmetrical manner. Earlier pressure predictions by third parties, based on preliminary estimations with hemispheric charges, were significantly underestimated.

On 15 August 2019, the explosive charge of 38 tonnes of explosive was detonated. The image sequence (figure 6) shows the first 200 ms after ignition. The fireball with a diameter of 120 meters and the propagation of the air blast are clearly visible.

Conclusion

The blast test SHIELD offered an opportunity – hitherto unique in Europe – to expose different elements of protective infrastructures to a test under close-to-reality conditions. The experiment was a success not least thanks to the collaboration between national and international partners. The experience of the Collective Protection Branch with numeric simulations of explosion effects provided an important foundation for the preparation of the experiment. The simulation and its successful experimental validation are important steps towards describing the impact of terror attacks with vehicle bombs.

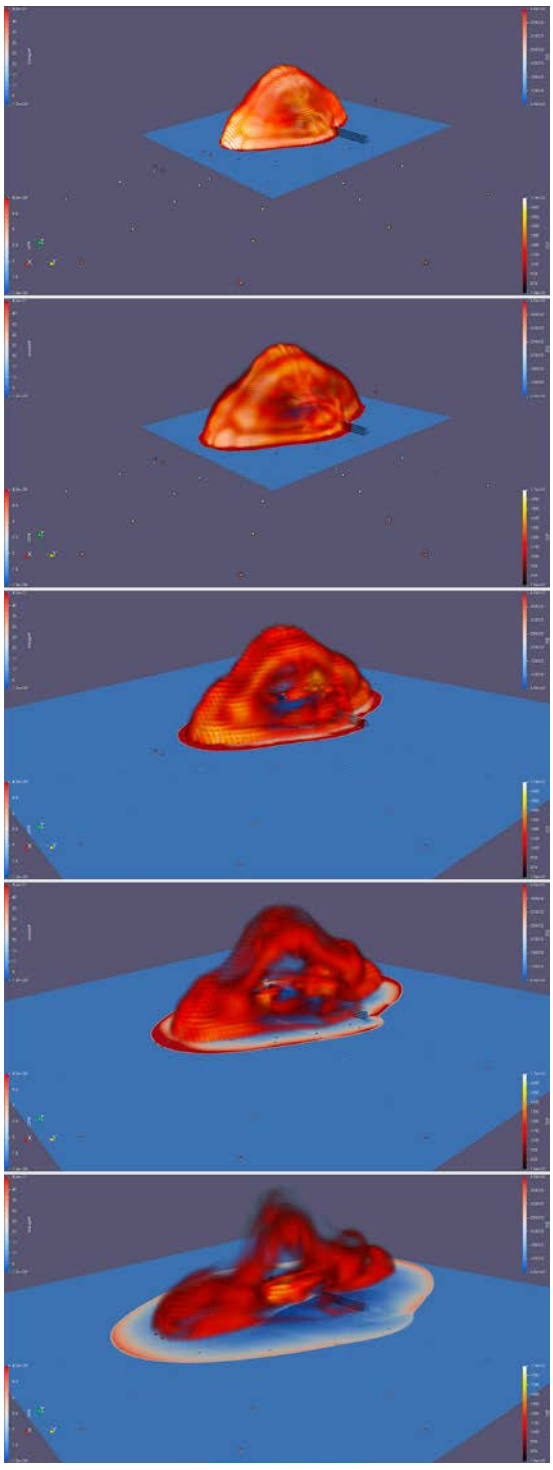


Figure 5: CFD simulation of the air blast propagation (Apollo Blast Simulator).

Figure 6: Blast test at Älvdalen Shooting Range on 15 August 2019.

Highly sealed rooms ensure safety at Spiez Laboratory

Laboratories working to the highest safety standards set high demands on their construction and technical systems. A sophisticated technical strategy is needed to prevent the release of organisms from the laboratory area at all times, including during extraordinary operating situations. For the containment to operate efficiently, the laboratory rooms must be sealed off as tightly as possible from the outside. This is why the integrity of all protection mechanisms must be periodically tested. To this end, standardised methods for the determination of room airtightness are being employed.

It is a perfectly normal Thursday morning in the Bernese Oberland as two virologists of Spiez Laboratory prepare for a routine entry into the biosafety laboratory. In the suiting-up room, the two carefully check their protective suits before entering the laboratory. In their suits that are inflated with breathable air, the two researchers look a bit like (helmet) divers moving along the seabed. The protective suits are constantly supplied with air through a blue hose, and thus kept at a slight overpressure to prevent air particles from penetrating into the suit through minute cracks.

The researchers examine a cell culture flask under the microscope: individual spots can be observed in the cell layer. These holes, or plaques, are caused by the cytopathic effect when replicating virus particles. A simple light microscope is sufficient to check whether a virus cultivation has been successful (figure 1).

Workplace in the biosafety laboratory.

Ventilation system of the biosafety laboratory.

If the viruses belong to risk group 4 – high consequence pathogens without available therapeutic treatment option – it is mandatory that this work be conducted in a biosafety laboratory of the highest level 4. One then speaks of a biosafety level (BSL) 4 laboratory, like the one in Spiez Laboratory – the only BSL-4 laboratory equipped with positive-pressure suits in Switzerland. An example for a risk group 4 virus is the Ebola virus, probably the best-known pathogen which causes haemorrhagic fever.

Containment strategy

An extraordinary operational situation in the laboratory could for example, result from the spillage of biologically active material outside a safety workbench. A possible escape of a pathogen could occur in the form of an aerosol leaking through the ventilation or through openings in the room envelope. Such laboratory incidents are rare but can happen with considerable aerosol formation. This is why the laboratories are kept at a negative pressure in relation to the neighbouring rooms, and the laboratory air flows through two H14 HEPA filters before leaving the building. This safety concept is called «dynamic containment» (a form of encapsulation) – it functions in exactly the opposite way of a cleanroom, directing an airflow from any leaky points in the room envelope into the contaminated zone. All interfaces to the outside world, such as personnel airlocks, the hatch for solid waste, as well as the laboratory wastewater are equipped with chemical or thermic decontamination systems in the form of chemical showers, autoclaves and wastewater sterilisation units.

The dynamic containment or the maintenance of a negative pressure inside the laboratory rooms depends on a properly functioning ventilation system. Yet, in case of a failure of the ventilation system, how can the containment principle be maintained? For such an emergency scenario, many BSL-4 laboratories are in addition equipped with gastight flaps in the ventilation ducts, which are immediately activated in case of loss of the dynamic containment, thereby closing off the room. This is called a static containment. In this way, the room is isolated and the room envelope tightly sealed off from the outside. Static containment forms the most important redundancy in the encapsulation of potentially contaminated air in case of a failure of the ventilation system and therefore a loss of dynamic containment.

This situation is comparable to what occurs during room fumigation, which has to be performed regularly for decontamination purposes. However, in this case the ventilation system is deliberately switched off so that the gas concentration inside the rooms can be controlled

Highly sealed rooms and their testing

In order for the static containment to function efficiently, the laboratory rooms must be as tightly sealed as possible to the outside. Consequently,

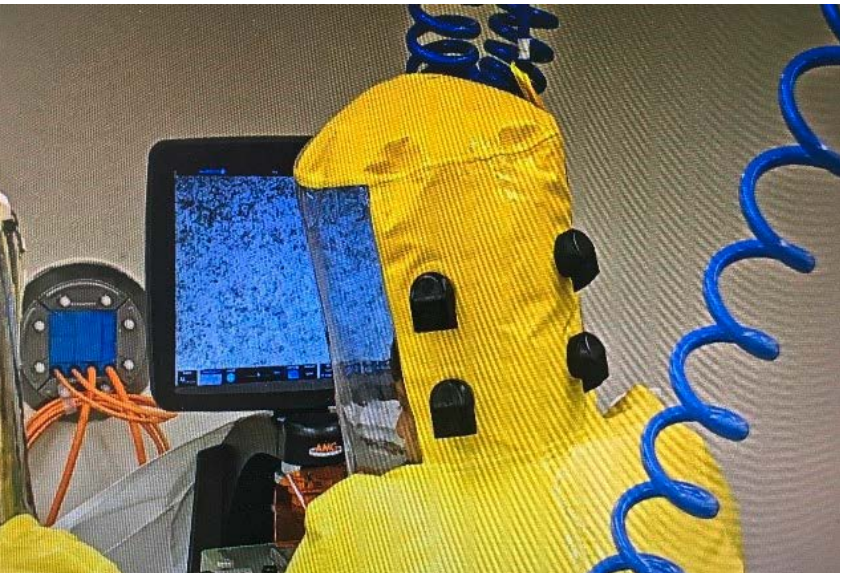


Figure 1: The recording of a surveillance camera shows the monitoring of virus cultivation in the biosafety laboratory.

all of the many inlets and outlets of the room envelope – such as penetrations for cables and media, as well as windows and doors – have to be sealed. This is in particular important because in an isolated laboratory room, any remaining active heat sources will cause pressure build up as a result of air expansion. A tight room envelope prevents the release of air into the environment. For this reason, it is essential that the integrity of the entire surface of the containment envelope is periodically inspected. This is normally done during the annual maintenance periods, using standardised methods for determining the tightness of the room, when the rooms are in a decontaminated state.

The term «room tightness», however, is somewhat misleading, because completely airtight laboratory rooms do not exist. The room tightness is measured in form of an air leakage volume flow at a given differential pressure. In other words, what is being measured is in fact the room «untightness». Because the static containment corresponds to a surface that forms a barrier – a so-called «sealing plane» - what is actually being measured, is the air volume which leaks through the entire surface area of the containment over a given period. On this basis, the room tightness class can be determined. In Spiez, the VDI standard for the tightness of containments[1] forms the basis for the room tightness measurements. It provides results in the form of units of air permeability at a given test pressure, expressed in l/m² x sec.

Air ducts outside the containment have long been tested in accordance with the norms for duct tightness. The VDI 2083 mentioned above, builds on these norms and integrates air duct safety classes A to D (in accordance with DIN EN 15727[2]) into the room tightness classes 1 to 4. In addition, the guideline describes the additional room tightness classes 5 to 7. In order to classify the containment in Spiez, three more classes were added (8, 9 & 10); this however no longer corresponds to the official guidelines. VDI 2083 now proposes to apply airtightness class 5 as guidance for a BSL-4 laboratory.

1 VDI 2083 Sheet 19:2018-08 Reinraumtechnik; Dichtheit von Containments; Klassifizierung, Planung und Prüfung (Cleanroom technology; Tightness of containments; Classification, planning, and testing). Berlin: Beuth Publishers.

2 DIN EN 15727:2010-10 Lüftung von Gebäuden; Luftleitungen und Luftleitungsbauteile, Klassifizierung entsprechend der Luftdichtheit und Prüfung; Deutsche Fassung EN 15727:2010 (Ventilation for buildings;

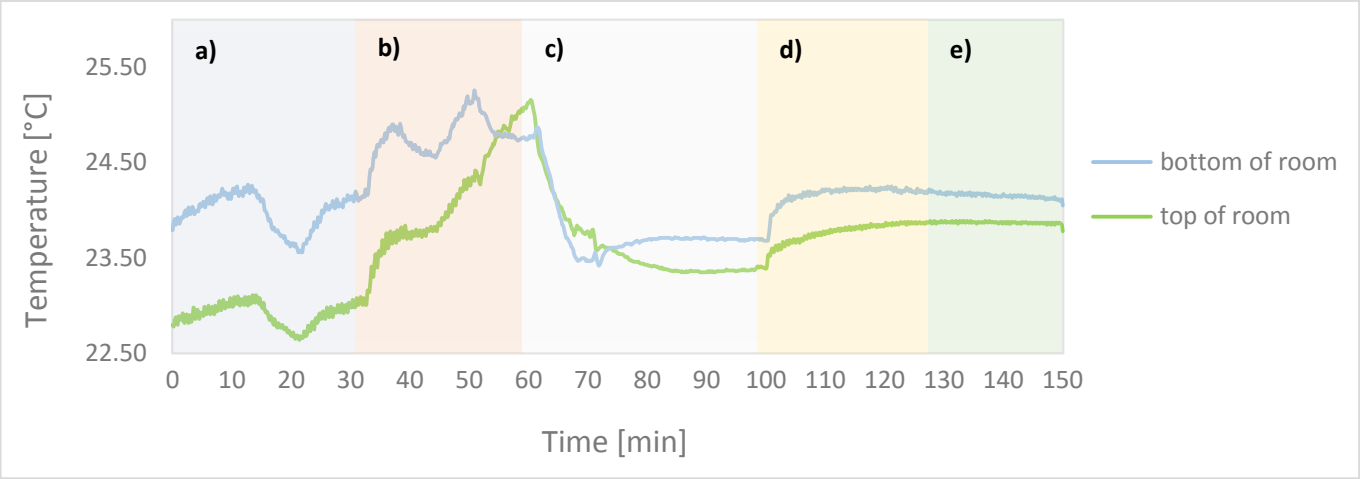


Figure 2: The temperature stabilisation in the room takes a certain amount of time, and heat sources must be eliminated for the measurement. The graph above shows the stepwise preparation of an air-conditioned BSL-4 room with a refrigerator running at –80 °C: a) normal operation, b) switch off room ventilation, c) switch off heat source and circulate room air, d) calibrate test pressure, e) start measurement.

Challenges

In highly sealed rooms, the air leakage volume flow can be so low that its measurement cannot be accurately accomplished. This is the reason why at Spiez Laboratory, the air leakage volume flow is not measured directly but indirectly mathematically calculated via a pressure drop measurement. For this pressure drop method at Spiez, the room is set to 500 Pa overpressure, and after a time lapse to allow for the room temperature above all surfaces to stabilise at an equal level (figure 2), the decrease in pressure is measured over a period of 20 minutes. Testing the containment under overpressure makes sense, not only because at the time of the test, the rooms are in a fumigated (decontaminated) state, but also because the overpressure simulates an emergency, which would trigger the use of the static containment.

Another challenge for the leak test are temperature variations, which can significantly distort the measurement results. A rise in room temperature of as little as 0,1 °C can lead to a pressure increase of 35 Pa. This is why during the measurement, the temperature change in the room should be accurately recorded and a thermal pressure correction factor be calculated. In relation to the changes in the room temperature, this factor compensates for all thermic factors that influence the pressure values measured. Other reasons for measurement inaccuracies include changes in atmospheric air pressure, air pressure fluctuations in adjacent rooms, and in general too low differential measurement pressures.

Conclusions

In contrast to other frequently applied rules and regulations, which define a threshold for room tightness and on that basis classify a room as «sufficient» or «insufficient», the range of tightness classes used by the VDI standard bestows each tested room a kind of «fingerprint». In this way, the regular verification of the room tightness provides important additional information: if a room's fingerprint changes from year to year in form of a decrease in tightness class, this is indicative of a new leak. An experiment in Spiez showed that a BSL-4 room that normally meets tightness class 9 (adapted from VDI 2083), drops to tightness class 7 in case of a simulated leak of 4 mm diameter at a test pressure of 500 Pa (figure 3).

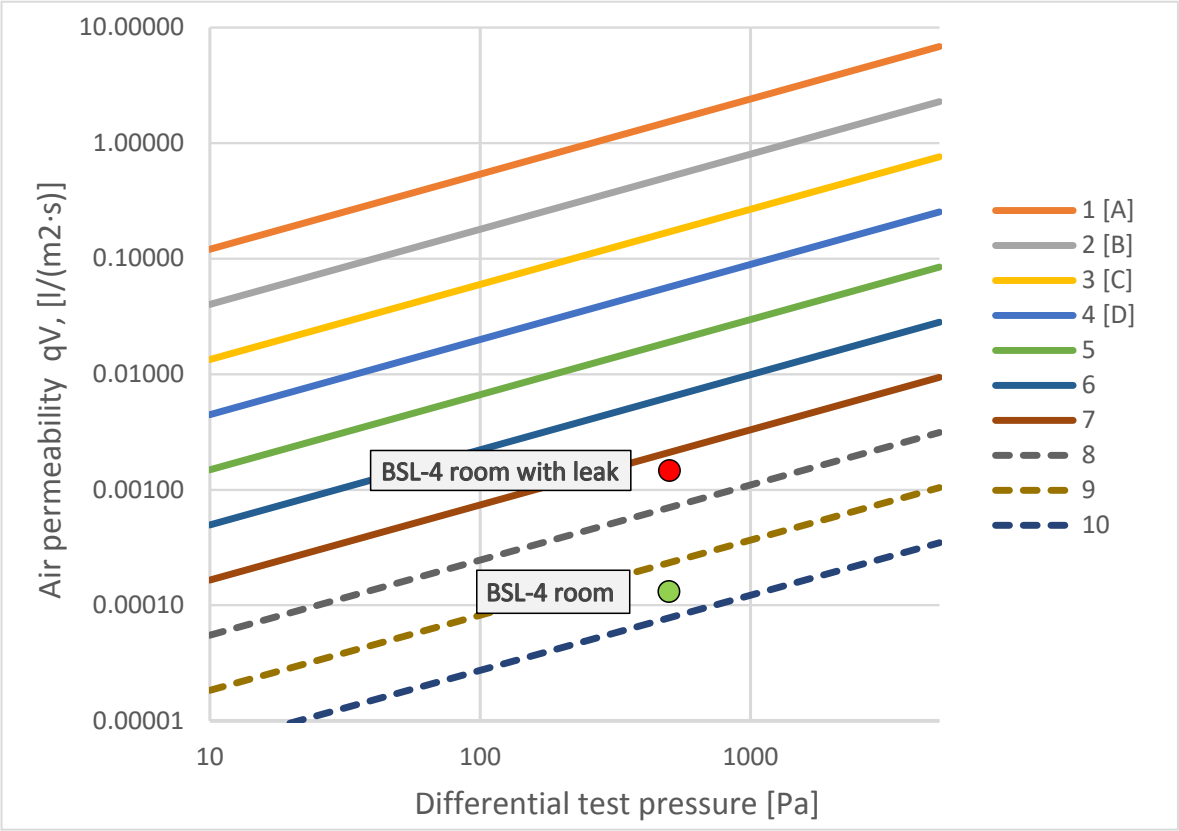


Figure 3: Airtightness classes, as used at Spiez Laboratory, adapted from VDI 2083. The graph shows the measurement data of a BSL-4 room before and after the occurrence of a simulated leak of 4 mm in diameter.

The minimum requirements for room airtightness of BSL-4 rooms vary and depend on the work to be conducted there and regulatory requirements. Therefore, the determination of a minimum tightness class must be based on a risk assessment and be tailored to the institution concerned. Spiez Laboratory is able to use the VDI 2083 as a basis for an adapted measurement methodology, as well as the extended classification scheme for BSL-4 rooms and apply this in its annual inspection of the room tightness. In this way, it can detect and swiftly remedy newly emerging leakages. This ensures that the static containment will always function during gassing and as a redundancy back up in an emergency.

Publications

***Abstract translated into English, but report only published in German.**

Nuclear Chemistry Division

José Corcho, Meyzonnat, G., Barbecot, F., Corcho Alvarado, J.A., Lauzon, J., McCormack, R., Tognelli, A., Zeyen, H. and Alazard, M.

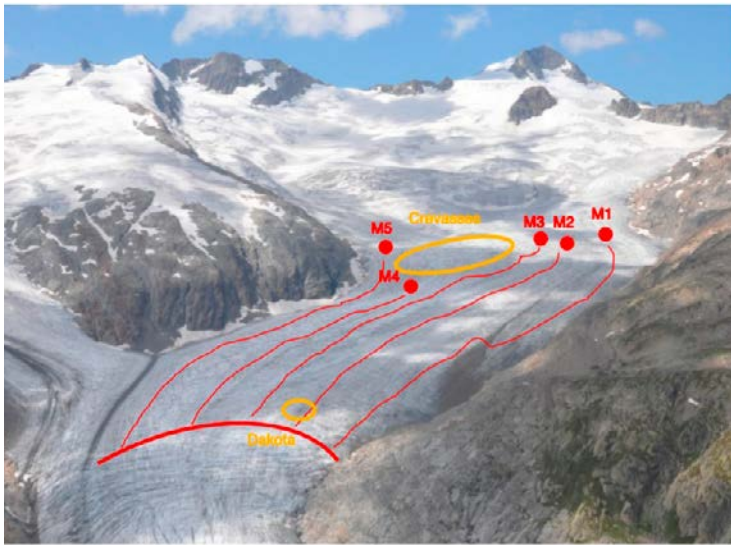
Borehole Heat Budget Calculator: A new tool for the quick exploitation of high-resolution temperature profiles by hydrogeologists
Journal of Water Resource and Protection, 11, 122–147. doi: 10.4236/jwarp.2019.112008

José Corcho, Hans Sahli, Stefan Röllin

Bestimmung von Plutoniumisotopen in Wasserproben*
LN 2019-01 CORJ

Plutonium concentrations in water samples are very small. The 239Pu activity concentration in river water is of the order of 3 µBq / kg and in rainwater about 0.1 µBq / kg. In this laboratory note, the measurements of three different sample preparation methods for water are compared. The samples were measured using the Element XR ICP-MS and the Neptune ICP-MS. Pu yields of almost 100% were achieved with all three methods. A large sample volume is required at the lowest detection limits and, in such cases, Pu pre-concentration (iron hydroxide precipitation) and separation steps are also needed. The sample preparation methods were tested in three types of water samples (melted glacial ice, river water, and sea water). Of particular interest were the ice samples from the glacier, in which the Pu measurements were used for dating purposes. The glacier ice samples were taken during the Swiss Army repeat course, by Abw Lab 1 on the Gauli Glacier (figure 1). Traces of plutonium could be found in a contiguous area of the glacier, which suggests it was related to ice from the 1960s. The results are used to set constraints for model calculations of the glacial ice flow.

Figure 1: Locations for ice sampling in the Gauli Glacier (parallel lines M1 to M5). The location of the accident aircraft Dakota is indicated.



Cédric von Gunten

Gadolinium-markierte Munition: Abschätzung der Umweltgefährdung*
LN 2019-01 VGCE

Gadolinium, a metal from the lanthanoid (rare earth) group, is used, among other things, to mark ammunition. Such marked ammunition is only available to certain authorities in Switzerland. It is used for training purposes, which results in the release of gadolinium at shooting ranges.

The lanthanoids follow the Oddo-Harkins rule and therefore form a characteristic distribution in the earth's crust (figure 2). If anthropogenic gadolinium is introduced into the environment (e.g. via shooting), this can be determined based on an anomaly in this characteristic distribution (figure 2 and figure 3).

To estimate the environmental impact, a shooting range was examined for anthropogenic gadolinium. Non-natural gadolinium could only be deter-

mined at trace levels ($\omega(Gd_{anthropogen})$ = 0.3 µg/g). Taking into account the size of the shooting range examined and the limited use of marked ammunition at the shooting range, Gadolinium therefore should not lead to any significant environmental pollution on shooting ranges also in the coming years.

Figure 2:

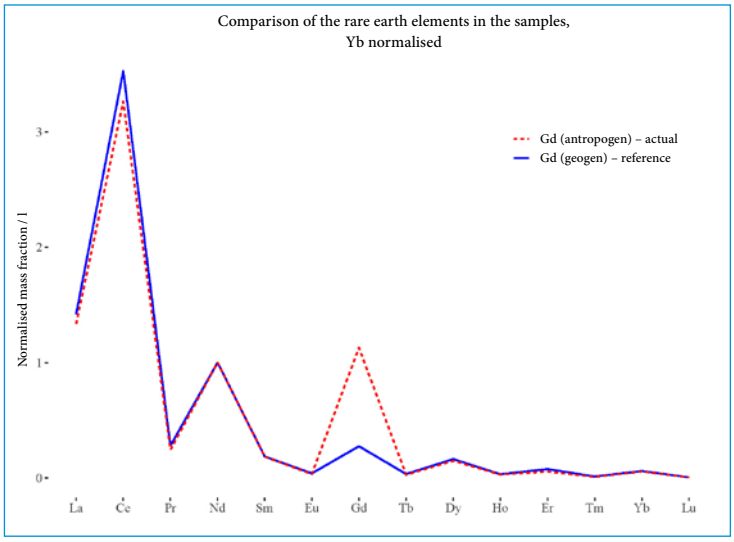
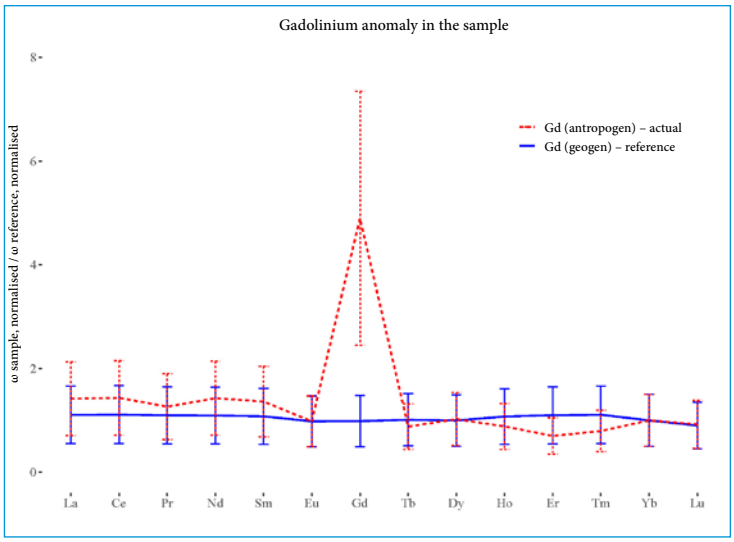


Figure 3:



Cédric von Gunten

Bestimmung der Haupt- und Spurenelemente verschiedener Stahlproben mittels ICP-Massenspektroskopie und saurem Aufschluss
LN 2019-02 VGCE

Cédric von Gunten

Validierung neuer Spritzenfilter zur Probenvorbereitung
LN 2019-03 VGCE

Cédric von Gunten

Kurzvalidierung des neuen Autosamplers und des neuen FAST Systems
LN 2019-04 VGCE

Cédric von Gunten

Bestimmung der in-house Probenaufarbeitungsunsicherheit
LN 2019-05 VGCE

Cédric von Gunten

Testing of Lishtot Testdrop Pro for the expert group «Water, Sanitation and Hygiene» WASH of the Swiss Humanitarian Aid Unit SHA
LS 2019-07

Jasmin Ossola

Validierung des QuickTrace® M-8000 Mercury Analyzers
LN 2019-01 OSJA

André Pignolet

Laborabwasser-Neutralisationsanlage Jahresbericht 2018
LN 2019-01 PAN

Stefan Röllin

Isotopenverdünnungsanalyse von Plutonium
LN 2019-01 ROF

Stefan Röllin

Altersbestimmungen von Plutonium
LN 2019-02 ROF

Hans Sahli

Low level Bestimmungen von radioaktiven Cäsium-Isotopen in Wasserproben. Methodenentwicklung an Meerwasserproben aus Fukushima
LN 2019-01 SAHH

Marc Stauffer

Ringversuchsergebnisse 2018 der Prüfstelle STS 0028
LN 2019-01 STM

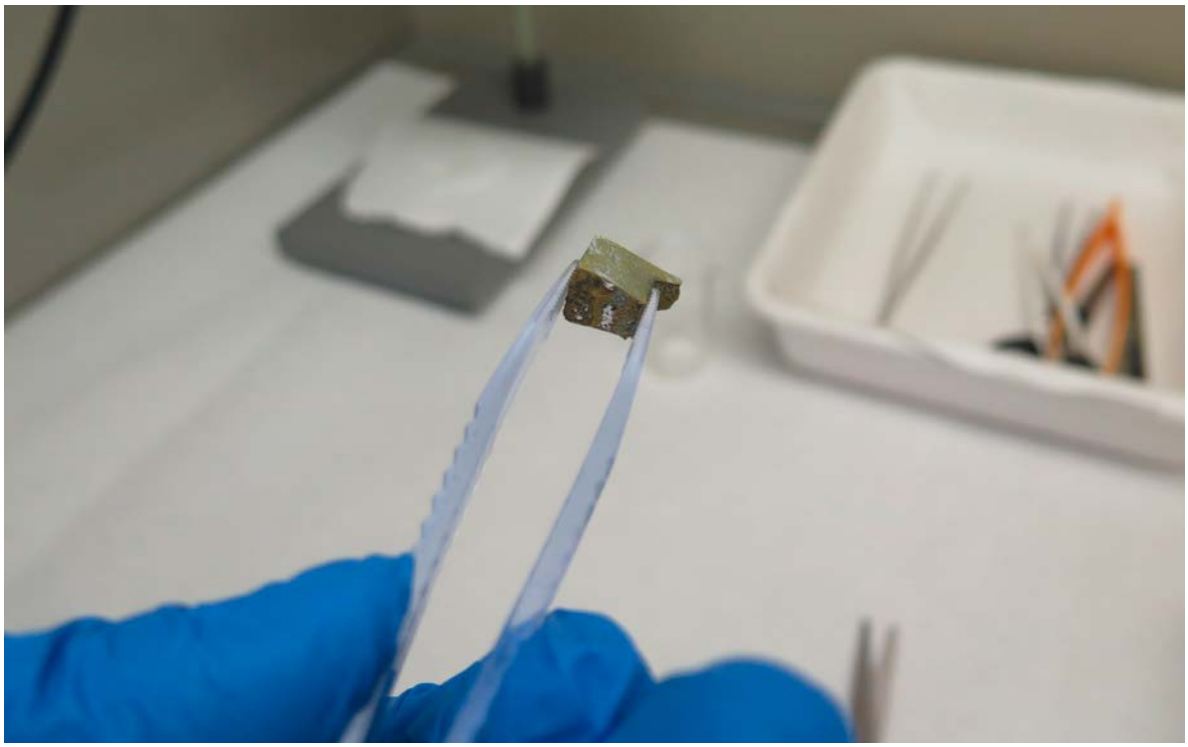
Dr. Christoph Wirz, Marc Stauffer, Dr. Nina Mosimann, Christian Saxer, Forensisches Institut Zürich (FOR)

Collaborative Material Exercise 6 (CMX-6) Anwendungsübung der analytischen Prozesse für die Nukleare Forensik*
LN 2019-04 WIC, STM, SNIN

Nuclear forensics is the study of radioactive material using analytical techniques to determine the origin and history of this material as part of an investigation by law enforcement agencies. The International Technical Working Group for Nuclear Forensics (ITWG) develops guidelines and organises exercises with the aim of promoting the scientific discipline of nuclear forensics and offering the responsible national or international authorities a common approach and effective technical solutions. At the end of 2018, Spiez Laboratory, together with the Forensic Institute Zurich (FOR), participated for the first time in a «Collaborative Material Exercise» (CMX) of the ITWG. The LN documents the approach for dealing with these complex issues. It describes the cooperation with the FOR, the measurement results and interpretations, the reporting, as well as findings with regard to weak points and optimisation possibilities.

One of the samples to be examined consisted of the chemical element cerium, which was contaminated with plutonium. The isotope composition of the plutonium and its age were determined, and fit for legal purposes statements were made as to which other samples this specific plutonium contamination matches (graded decision framework).

One of the samples consisted of the chemical element cerium, which was contaminated with plutonium.



Biology Division

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Standardized focus assay protocol for biosafety level four viruses
J Virol Methods. 2019 Feb; 264:51-54. doi: 10.1016/j.jviromet.2018.12.002. Epub 2018 Dec 1. PubMed PMID: 30513365.

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Comparison of Four Commercial IgG-Enzyme-Linked Immunosorbent Assays for the Detection of Tick-Borne Encephalitis Virus Antibodies
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Stefanie Gobeli Brawand, Sonja Kittl, Martina Dettwiler, Andreas Thomann, Simon Feyer, José Cachim, Grégoire Theubet, Nicole Liechti, Matthias Wittwer, Nadia Schürch, Simone Oberhänsli, Andreas Heinimann and Jörg Jores

An unusual case of bovine anthrax in the canton of Jura, Switzerland in 2017 *
BMC Veterinary Research, 2019, 15:265.
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Outbreak of anthrax in the the canton of Jura.

At the beginning of May 2017, there was an outbreak of anthrax on a farm in Villars sur Fontenais in the canton of Jura, which led to the death of two cows. The last known case in the Jura dates from 1993. A small depression in the sector of the pasture area which was connected to a former cadaver site by a widely branched cave karst system, was suspected as the source of the contamination. It had been opened temporarily by a speleologist a few days before the outbreak, which presumably lead to a leakeage of water contaminated with anthrax spores and its seeping into the pasture. Although the examination of numerous grass and soil samples was negative, this remains the most plausible hypothesis. Phylogenetic analysis of the isolate revealed a genotype of endemic origin. This shows that anthrax spores indeed can persist in the environment for decades and may lead to an outbreak.

Maximilian Brackmann, Stephen L. Leib, Mauro Tonolla, Nadia Schürch, Matthias Wittwer

Antimicrobial resistance classification using MALDI-TOF-MS is not that easy: lessons from vancomycin-resistant Enterococcus faecium
Clinical Microbiology and Infection. doi: https://doi.org/10.1016/j.cmi.2019.10.027.

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Roman Schönenberger

Etablierung eines massenspektrometrischen Verfahrens für den Nachweis von Viren mittels rapifleX MALDI-TOF/TOF MS System am Beispiel von Flavivirenkulturen aus Zellkulturlinie Vero C1008 CRL-1586TM
https://www.medi.ch/arbeiten/poster-schoenenberger-roman.pdf

Denise Siegrist, Dr. Roland Züst, Dr. Olivier Engler

Validierungsbericht der End-point RT-PCR für den Nachweis und Identifikation von Lassa-Viren
LS 2019-06

Denise Siegrist, Dr. Roland Züst, Dr. Olivier Engler

Validierung der End-Point RT-PCR für den Nachweis und Identifikation von Filoviren
LN 2019-13 SIDE, ZUET, ENO

Torriani G, Trofimenko E, Mayor J, Moreno H, Michel S, Heulot M, Chevalier N, Zimmer G, Shrestha N, Platte P, Engler O, Rothenberger S, Widmann C, Kunz S.

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Fritz Wüthrich

Mikrobiologische Trinkwasseranalytik
LS 2019-03

Dr. Roland Züst, Denise Siegrist, Dr. Oliver Engler

Validierung der End-Point RT-PCR für den Nachweis und Identifikation von SARS Viren
LN 2019-14 ZUET, SIDE, ENO

Schneeberger PHH, Fuhrimann S, Becker SL, Pothier JF, Duffy B, Beuret C, Frey JE, Utzinger J.

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Chemistry Division

Thomas Clare

Validierung des GC-MSD/dFPD Systems Agilent 7890B/5977A (MSD6): Performancevergleich mit baugleichem GC-MSD/dFPD System Agilent 7890B/5977A (MSD5)
LN 2019-01 CLA

Urs Meier

Chemische Forensik im Bereich der Chemiewaffen
LN 2019-02 MRU

Thomas Clare, Peter Siegenthaler

Maskierung von CWC-relevanten Verbindungen durch Matrixkomponenten bei der Detektion mit GC-dFPD, GC-µECD, GC-NPD und GC-AED
LN 2019-03 CLA, SIG

For the specific detection of volatile organic compounds, the group Organic Analytics uses gas chromatographs with nitrogen-phosphorus detectors (NPD), dual flame photometer detectors (dFPD), micro electron capture detectors (µECD) and atomic emission detectors (AED). As part of an analytics project, the extent to which the specific detection of CWC-relevant compounds is made more difficult by matrix components has been studies.

Andreas Schorer, Jean-Claude Dutoit

Vergleich von Extrelut und Chem Elut «Supported Liquid Extraction» (SLE)
LN 2019-04 ANDRS, DUT

Thomas Clare

Validierung des Gerstel TD 3.5+ / Agilent 7890B/5977B TD-GC-MSD/dFPD Systems (TD3-MSD7) im Modus für Flüssig-Injektion: Performancevergleich mit dem Agilent 7890B/5977B GC-MSD/dFPD System (MSD6)
LN 2019-05 CLA

Andreas Schorer, Martin Schär, Marco Elmiger, Peter Siegenthaler

Nachweis von Fentanyl, Carfentanil und Remifentanil in Wasser- und Wischproben mittels GC-MS und LC-MS*
LN 2019-06 ANDRS, SCM, ELM, SIG

Urs Meier

Forensische Analyse der Deuterium/Wasserstoff (2H/1H) Isotopenverhältnisse in CWÜ-relevanten Verbindungen unter Anwendung der NMR-basierten SNIF-Technik (Site-Specific Natural Isotope Fractionation)
LN 2019-07 MRU

Andreas Zaugg, Martz Severin

Synthese und Charakterisation von racemischem Bornylchlorid sowie den jeweiligen (+)/(-)-Stereoisomeren
LN 2019-01 ZAA, MSEV

Fausto Guidetti, Michael Arnold

Messkampagne mit dem X-am 8000 der Firma Dräger
LN 2019-01 GIF, ARND

Fausto Guidetti

Prüfung von Nachweisplättchen des Kampfstoffnachweisgerätes KANAG
LN 2019-02 GIF

Benjamin Menzi

Sichtbarkeit von verschiedenen chemischen Kampfstoffen mit ultraviolettem Licht (UV365 und UV254)
LN 2019-01 MEN

Luca Moschen, Benjamin Menzi

Herstellung von Alkylphosphonsäurechlorfluoride
LN 2019-01 LMO, MEN

Roland Kurzo, Jan Klopfenstein

Herstellung von Chlorpikrin (PS)
LN 2019-01 KURO

Dennison, G. H.; Curty, C.; Metherell, A. J.; Micich, E.; Zaugg, A.; Ward, M. D.

Qualitative colorimetric analysis of a Ir(iii)/Eu(iii) dyad in the presence of chemical warfare agents and simulants on a paper matrix
RSC Advances 2019 9(14): 7615-7619

NBC-Protection Division

Dr. Christian Gloor

Dichtheitsprüfung von Schutzmasken mittels Helium
LS 2019-05

Regula Gosteli

Validierung der Kampfstoffbeständigkeitsprüfung statisch mittels Indikatorpapiermethode auf dem Kamerasystem KS-2/6
LN 2019-01 GOSR

Regula Gosteli

Vergleichsmessungen der Kampfstoffbeständigkeitsprüfung mittels Indikatorpapiermethode, Durchführung auf dem Kamerasystem KS-2/6 und YPAP21
LN 2019-02 GOSR

Regula Gosteli

Referenzmaterial für die Kampfstoffbeständigkeitsprüfung, Prüfung der Retentionszeit diverser potentiell geeigneter Polymerfolien gegenüber Yperit (HD) und HD:Chlorbenzol 80:20
LN 2019-03 GOSR

Marco Hofer

Sorptionsmittelprüfung mit Toluol nach SI4570 Erarbeiten eines neuen Prüfverfahrens
LN 2019-01 HOM

Dr. Gilles Richner

Integrale Prüfung der persönlichen C-Schutzausrüstung gegenüber Gas (ICPg) Weiterentwicklung der Methodik
LS 2019-08

Johann Stalder

Validierung der Messkette zu «3 t-Schockprüfmaschine SPM»
LN 2019-003 SJ

André Zahnd

Numerische Simulation der Luftstossausbreitung und Druckeinwirkung auf die Teststruktur mit dem CFD-Programm «Apollo Blastsimulator»
LS 2019-04

Logistics, Quality, Safety and Security Division

Breitenbaumer S., Lörtscher B., Weber B.

Höchste Ansprüche. Hochdichte Räume sorgen im Labor Spiez für Sicherheit
ReinRaumTechnik, 5/2019.

Beat Lörtscher

HIGH FLOW BIO-X Filter Messreihe Differenzdruck
LN 2019-02 LOB

Stefan Breitenbaumer, Beat Lörtscher

Sterilisationsprozess Abwassersterilisations-anlage BL
LN 2019-01 BRS, LOB

Beat Lörtscher

Optimierung Sterilisationsprozess nach beobachtetem Druckanstieg nach der Wartung
LN 2019-03 LOB

NBC-Coordination Unit

Dr. Natalie Kummer, Dr. César Metzger

Investigations forensiques lors d'incidents atomiques, biologiques et chimiques en Suisse
Revue internationale de criminologie et de police technique et scientifique. 2019/4.
P. 484–504.

Accredited laboratories

Round Robin tests October 2018 – September 2019

Accredited laboratory	Quant.	Type and Partner
STS 0019		Due to successfully concluded OPCW analysis assignments, Spiez Laboratory was released from participation in the proficiency tests and has been able to ensure the OPCW designation for another year.
STS 0022	1	Comparative sorbent tests with WIS Munster, GER
STS 0028	7	– International Soil Exchange ISE – University Wageningen – Potable water – Ielab – PT ALMERA – IAEA – PT Seawater RML – IAEA – PT IRA/BAG – Invivo round robin test – Federal Office for Radiation Protection GER
STS 0036	7	– International round robin tests organised by the German reference office for proficiency testing and reference materials (DRRR), Kempten
STS 0054	3	Bacteriology: Water Microbiology
	2	Bacteriology: Bacterial genome detection for Bacillus anthracis, Coxiella burnetii, Francisells tularensis, Brucella spp and Borrelia burgdorferi (provider: INSTAND e.V.)
	11	Virology: Orthopox (EVD LabNet) Arbo, Yellow Fever, Zika (QCMD) Westnile PCR (QCMD) Dengue PCR (QCMD) Chikungunya PCR (QCMD) FSME serology (INSTAND) June 2019 Hanta serology (INSTAND) Westnile PCR (INSTAND) FSME serology (INSTAND) Nov. 2019 MERS PCR (QCMD)
STS 0055	0	No round robin tests

Published by:
The Federal Department of Defence,
Civil Protection and Sport DDPS
Federal Office for Civil Protection FOCP
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